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Lessons Learned on Army Commercially Financed Facilities

by

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The U.S. Army may acquire new facilities by building them through Military Construction, Army (MCA) or by engaging private contractors to build commercially financed facilities (CFFs). The principal driving forces for the increased Army use of CFFs have been the reduction in direct appropriations for facilities for the armed services, and the belief that some of the services associated with these facilities can be provided more efficiently by the private sector. The continued growth of CFFs has long-term funding implications for the Army.

This report reviews the results of a study conducted March through December 1989 of planned and existing CFF projects. It includes the results of a survey and interviews with installation personnel directly involved with these projects.

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13. ABSTRACT (Maximum 200 words) The U.S. Army may acquire new facilities by building them through Military Construction, Army (MCA) or by engaging private contractors to build commercially financed facilities (CFFs). The principal driving forces for the increased Army use of CFFs have been the reduction in direct appropriations for facilities for the armed services, and the belief that some of the services associated with these facilities can be provided more efficiently by the private sector. The continued growth of CFFs has long-term funding implications for the Army. This report reviews the results of a study conducted March through December 1989 of planned and existing CFF projects. It includes the results of a survey and interviews with installation personnel directly involved with these projects. <i>Keywords</i>			
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EXECUTIVE SUMMARY

Purpose of the Study

The Programming and Execution Support Office (PESO) of the Military Programs Directorate (CEMP-P), HQUSACE tasked the U.S. Army Construction Engineering Research Laboratory (USACERL) to study completed and planned Army commercially-financed facilities (CFFs). CFFs include the following sections of Title 10 in the U.S. Code (10USC): 2828-Build to Lease Housing (801), 2821-Rental Guarantee Housing (802), 2394-Energy or Fuel Contracts; 2809-Long Term Facilities Contracts, and 2667-Land Leases.

This report documents a study of CFFs performed for USACERL by Arthur D. Little, Inc., to identify the lessons learned from existing and planned Army CFF projects, and to provide Army leadership with empirical information on CFFs to develop improved policy and guidance procedures for successfully initiating and/or accomplishing future CFFs. Further, this study was to review and suggest improvements in the methods of economic analysis used to evaluate methods of providing Army facilities, by either commercially financed and operated facilities, or government constructed and operated facilities.

Methods

The study was conducted using questionnaires and installation visits that covered projects in the following stages:

- A current CFF project, i.e., one for which a contract was currently in effect or for which a contract had been awarded but later canceled.
- A planned CFF project, i.e., one for which an RFP had already been issued even though no contract had yet been awarded or for which an RFP would have been issued during the next six months.
- A canceled CFF project, i.e., one for which an RFP had been issued since 1983 and subsequently withdrawn without a contract being awarded.

This study began with a review of documents related to CFF projects, including the basic enabling legislation of Title 10 in the U.S. Code, relevant policy guidance, audit reports, and selected published reports.

An initial list of planned and actual CFF projects by installation and by type was compiled. The final list of projects that were the subject of this study were screened from the initial list.

A questionnaire was drafted covering relevant facets of CFF project initiation, economic analysis methodology, bid solicitation, and contract management. The questionnaire covered important areas of Army experience with CFFs, including project need assessment, bid solicitation and evaluation, economic analysis, and contract management, and was sent to 20 installations with 32 planned or actual projects in various stages of completion or operation. Six installations were visited and in-depth interviews conducted with people directly involved with planned and actual CFF projects.



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Installation visits included interviews of personnel from the Family Housing Office, Directorate of Engineering and Housing, Accounting and Finance, and in some cases, contracting personnel from the district office of the Army Corps of Engineers and private sector developers. These 1- or 2-day stays included site visits to completed projects, which in most cases were 801 or 2667 land lease housing projects.

A working group on CFF comprised of Army representatives from Headquarters, U.S. Army Corps of Engineers (HQUSACE), the Engineering and Housing Support Center (CEHSC), and the U.S. Army Corps of Engineers, Huntsville Division (HND) provided assistance. This group was briefed regularly on the work plan, questionnaire responses, site visits, and conclusions of the study, and its comments, suggestions and advice were incorporated into the study.

Principal Findings

The U.S. Army may provide new facilities by either building them through Military Construction, Army (MCA) or by engaging private contractors to build commercially financed facilities (CFFs). The principal driving forces for Army use of CFFs have been the reduction in direct appropriations for facilities for the armed services and the belief that some of the services associated with these facilities can be provided more efficiently by the private sector. The continued growth of CFFs has long-term funding implications for the Army. Although projected costs of a CFF may presently be less than the projected costs of a similar MCA facility, each CFF creates a future financial obligation without guaranteed funding or borrowing authority. In other words, what would be a direct appropriation for facilities under MCA is converted into a longer-term annual obligation, which is intended to provide an equivalent service, but which is also subject to annual appropriations. Policy makers and commanders should note that the combination of fixed payments and government nonownership of facilities reduces Army flexibility to reallocate resources.

Another consideration in comparing CFFs to MCAs is the matter of specifications. Normal MCA specifications are not used in CFF construction. If MCA construction could use these more flexible specifications, the Army might gain better long-term economic savings with MCA than with CFF contracting. This is because CFF construction adds the cost of a middle man, the contractor, who has a higher cost of financing than does the government.

Proposed CFF projects must be analyzed to ensure that the net present value of their costs is less than the net present value of MCA costs. When the present value of expected costs has been lower under CFF than under MCA, it has often reflected the fact that private CFF contractors could achieve substantially lower construction costs than MCA and/or generate additional revenues for their project beyond those provided by the government (e.g., cogeneration of electricity). These advantages that a CFF contractor can achieve sometimes outweigh the higher costs of capital incurred by private parties.

Even so, CFF contracts may have less cost advantage than is immediately apparent, considering that some cost comparisons include neither the cost of on-post land, nor the full market or economic value to the Army of the residual value of an MCA project. Moreover, energy and other nonlease projects use a discount rate of 10 percent (mandated by Office of Management and Budget [OMB] Circular A-94 and unchanged since 1972). This rate is different than the one used in lease vs buy analyses as prescribed by OMB Circular A-104.

Conclusions

Project Performance and Feasibility

Although the Army has only a few actual CFF projects in place, several aspects of project performance and feasibility are evident:

1. Contracts under the 801 housing program often provided housing faster and at a slightly lower present value of contract costs than the present value of MCA was estimated to have cost if built. The lower present value of costs are apparently due to lower construction costs because private contractors are allowed to employ somewhat more flexible design specifications than MCA.
2. The 802 housing program appears to be infeasible because, even with the rental occupancy guarantees, the BAQ/VHA payments used by service men and women to pay rent are usually below levels needed to make new construction profitable.
3. Section 2394 thermal energy contracts appear to be economical when structured as utility service contracts with waste energy facilities that are financed by tax exempt bonds or as part of cogeneration facilities in some geographical areas. In these cases utilities would make avoided cost payments for electricity in accordance with the Public Utilities Regulatory Policy Act high enough relative to costs to justify investment by private parties.
4. No conclusive evidence of the success or failure of the 2809 facilities program was revealed, because to date, there have been no successfully awarded or completed 2809 projects.
5. It is too early for evidence of the success or failure of the new 2812 facilities program (established by legislation passed by Congress in November 1989).
6. Developers have difficulty financing projects without noncancellation or debt service guarantees that may reduce the Army's flexibility in allocating resources because of termination obligations and because the Army does not own the facilities involved.
7. CFF contracts that maintain a lessor tax status for contractors may be better than those that result in installment sale status since the latter may reduce the willingness of contractors to participate due to the tax treatment of installment sales.

Project Management

Commercial financing of facilities has enabled the Army to obtain services from the use of facilities that might not otherwise have been available given current limitations on funding for MCA construction. However, continued use of commercial financing for facilities has long-range implications for the Army budget. The informal and, in some cases, formal guarantees given to contractors that the government either will not cancel a CFF project or will guarantee the service of debt, as is the case with the energy project at Aberdeen Proving Ground, may reduce the long-term flexibility of the Army to adjust its budget commitments to actual requirements.

Under current rules, CFF contracting is beneficial to the Army only in two cases. One cost advantage accrues when the contractor can achieve significantly (at least 15 to 20 percent) lower construction costs than what the Army could achieve in constructing a similar facility. A second benefit occurs when a

single facility generates additional revenues while still meeting the service needs of the Army, as in the case of energy plants that supply steam or hot water to the Army, and also cogenerate electricity for sale to the local electric grid.

For nonlease projects, use of a high discount rate may lead to Army spending for facilities with future payments discounted at higher rates than the current inflation-adjusted opportunity cost to society of government spending. There is also an inconsistency in the discount rates cited in OMB Circulars A-94 and A-104. The use of the low inflation rate of approximately 1.8 percent risks underestimating the actual future costs of CFF facilities. The MCA residual value should be an average of the OMB A-104 residual estimate (cost based), and the economic values of not having to renew an 801 lease, and the value of not paying BAQ/VHA allowances.

There is a need to build and maintain continuity of expertise in the management of the CFF project development process. Because different kinds of expertise (e.g., housing market analysis, economic analysis, design review) are required at different stages of CFF project development, it is important to have at least one person involved in reviewing and managing all steps of project development. According to some installation level personnel, the rate of staff turnover and conflicting job responsibilities makes this difficult to achieve. The management of energy contract development is an exception, since RFPs, economic analyses, and bid evaluations for energy contracts are centralized in the Huntsville Division. In this case, there is already a center of expertise available to work with installation personnel in the development of CFF projects.

Recommendations

General

To improve its management of CFF projects and to increase the probability of success of CFF projects with life-cycle contract costs actually less than those of MCA, it is recommended that the Army:

1. Establish centers of project-specific expertise for all types of CFF projects that can work with installation personnel to ensure continuity of project development management
2. Establish and require that a consistent set of cost variables (e.g., imputed land, insurance and property tax costs along with construction in the case of MCA housing) be used for all MCA-CFF life-cycle cost comparisons
3. Review the discount rate specified in Army regulation AR11-28 to ensure that it is consistent with the current inflation-adjusted opportunity cost of government spending, i.e., the return to society that would have been earned in the private sector, and with OMB Circular A-104, since both cover long term contracts for services from facilities built and owned by private contractors. (The choice of a proper discount rate should be taken up by OMB in concert with the Joint Economic Committee of Congress.)
4. Eliminate guarantees that the government will indemnify a contractor for cost risks that a contractor normally should be willing to bear in return for risk-adjusted financial returns
5. Establish appropriation codes to collect the costs of CFF facilities separately from other installation operating costs.

6. Continue to hold bidders' conferences so that all possible project contingencies are clarified to allow bidding on a consistent basis by all private developers
7. Thoroughly screen and evaluate all bidders, especially in the case of energy projects, before allowing them to bid
8. Continue to perform present value cost analyses in every case prior to the award of a bid, to ensure that the net present value of costs of the best and final offer continues to be enough lower than MCA to justify CFF.

Project Specific Recommendations

Several changes should be made in existing CFF project programs to improve the contribution of commercially financed facilities to the Army's mission:

1. The current Office of the Secretary of Defense (OSD) policy of retaining government responsibility for maintenance of 801 housing projects should be reviewed in light of the strong belief by some installation, Corps of Engineers, and private sector personnel, that CFF contractors provide better quality construction that lowers long-term maintenance costs in contractor-maintained housing. Any implementation of this recommendation must weigh the benefits of contractor-maintained housing against the greater ability of the Army to control the timing and cost of maintenance in government-maintained housing.
2. Policy should allow 801 housing projects to be located on post to reduce cash costs in high-cost land areas and to reduce the commuting costs of military personnel, provided that the fair market value of those sites is included in the comparison with costs of an off-post 801 project, and that flexibility is preserved for the government to retain the land and/or choose the most cost effective option for housing at the end of the lease. This was done with 2667 outleases of land at Fort Ord; it would seem that the ownership consequences of on-post 801 projects are reasonably similar to 2667 land outleases.
3. Since the 802 housing program is currently infeasible and all 802 projects have been canceled after time and expense costs to the Army, the program should be either restructured or abandoned.
4. Contracts for the purchase of energy from waste energy facilities should be standardized to avoid continual requests for FAR waivers known to be needed in advance.
5. Quality assurance of project construction must be increased, since CFF contractors attempt to minimize the investment cost (which lowers the annual rent) by building more quickly and cheaply.

FOREWORD

This work was conducted for the Directorate of Military Programs, Headquarters, U.S. Army Corps of Engineers (HQUSACE), under MIPR No. E8789L303, "Commercially Financed Facilities," dated September 1989. The Technical Monitors were Ms. Jill D. McLean and Mr. Daniel A. Hill, CEMP-P.

The project was performed by Arthur D. Little, Inc., under contract to the U.S. Army Construction Engineering Research Laboratory (USACERL), Facility Systems Division (FS). Mr. Alan M. Cody is employed by Arthur D. Little, Inc. The USACERL Principal Investigator was Mr. Robert D. Neathammer. Dr. Michael J. O'Connor is Chief of USACERL-FS. The USACERL technical editor was Mr. William J. Wolfe, Information Management Office.

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LESSONS LEARNED ON ARMY COMMERCIALLY FINANCED FACILITIES

1 INTRODUCTION

Background

The Army may acquire new facilities by either building them through Military Construction, Army (MCA) or by engaging private contractors to build commercially financed facilities (CFFs). In the latter case, facility maintenance may be retained by the Army or assigned to the contractor. The principal driving forces for increased Army use of CFFs have been the reduction in direct appropriations for facilities for the armed services, and the belief that some of the services associated with these facilities can be provided more efficiently by the private sector. The continued growth of CFFs has long-term funding implications for the Army. Although at present, projected costs of a CFF may be less than the projected costs of a similar MCA facility,¹ each CFF creates a future financial obligation without guaranteed funding or borrowing authority. In other words, what would be a direct appropriation for facilities under MCA is converted into a longer-term annual obligation, which is intended to provide an equivalent service, but which is also subject to annual appropriations.

Consistent with current policy, proposed CFF projects must be analyzed to ensure that the net present value of their costs is less than the net present value of MCA costs. When the present value of expected costs has been lower under CFF than under MCA, it has often reflected the fact that private CFF contractors could achieve substantially lower construction costs than MCA and/or generate additional revenues for their project beyond those provided by the government (e.g., cogeneration of electricity). These advantages that a CFF contractor can achieve sometimes outweigh the disadvantages of higher costs of capital incurred by private parties.

The U.S. Army Construction Engineering Research Laboratory (USACERL) was tasked to study completed and planned Army CFFs, including the following sections of Title 10 in the U.S. Code (10 USC): 2828 "(801) Build to lease (housing)"; 2821 "(802) Rental guarantee (housing)"; 2394 "Contracts for energy or fuel for military installations"; 2809 "Test of long term facilities contracts"; and 2667 "Leases: non-excess property."

Objectives

The objectives of this study were:

1. To evaluate the Army's experience with existing and currently planned CFFs with respect to project development, bid solicitation, and the performance of the projects relative to expectations

¹For this study, "MCA" will be used to refer to Military Construction, Army or other directly appropriated facilities.

2. To review and evaluate the methods used for economic analysis of the alternatives either to commercially finance, or have the government construct, own, and operate facilities, including review of the Army and Office of Management and Budget (OMB) methodologies for economic analyses and comparison of these required methods to those actually used to evaluate CFFs relative to MCA.

Approach

This study began with a review of documents related to CFF projects, including the basic enabling legislation of Title 10 in the U.S. Code, relevant policy guidance, audit reports, and selected published reports (Appendix A).

An initial list of all current, planned, and actual CFF projects was compiled and characterized by installation and project type (Appendix B). This list was narrowed to those projects to be included in this study (Appendix C).

A questionnaire was drafted covering relevant facets of CFF project initiation and important areas of Army experience with CFFs, including project need assessment, bid solicitation and evaluation, economic analysis, and contract management. It was sent to 20 installations that had 32 planned or actual projects in various stages of completion or operation. Six installations were visited and in-depth interviews conducted with people directly involved with the following planned and actual CFF projects:

- Aberdeen Proving Ground (2394 Energy)
- Fort Drum (801 Housing, 2394 Energy, and 2809 Waste Water)
- Fort Hood (801 Housing)
- Fort Ord (and Fort Hunter-Liggett) (2667 Land Leases)
- Fort Polk (801 Housing)
- Redstone Arsenal (and the Huntsville Division [HND]) (2394 Energy, 2809 Waste Water, and 2809 Sparkman Complex).

Installation visits included interviews of personnel from the Family Housing Office, Directorate of Engineering and Housing, Accounting and Finance, and in some cases, contracting personnel from the district office of the Army Corps of Engineers and private sector developers. These 1- or 2-day stays included site visits to completed projects, which in most cases were 801 or 2667 land lease housing projects.

A working group on CFF comprised of Army representatives from Headquarters, U.S. Army Corps of Engineers (HQUSACE), the Engineering and Housing Support Center (CEHSC), and the U.S. Army Corps of Engineers, Huntsville Division (HND) provided assistance. This group was briefed regularly on the work plan, questionnaire responses, site visits, and conclusions of the study, and its comments, suggestions and advice were incorporated into the study.

2 CFF LESSONS LEARNED

Overview

This discussion of lessons learned is organized first by type of project and then chronologically by lessons learned during project need assessment and evaluation, bid solicitation and evaluation, and contract completion and operation of the facility.

The 2812 facilities program, established by Congress in November 1989, was not researched in this study. Because no successful 802 housing projects or 2809 facilities have been completed, lessons learned for these two types of projects were rather limited. Several guest quarters projects were briefly reviewed during installation visits (e.g., Fort Drum) and via telephone. Since these quarters were developed using 2667 outleases of land, with nonappropriated funds, they were not within the scope of this study. The discussion of 2667 land lease projects relates entirely to the experiences at Fort Ord and Fort Hunter-Liggett, where the 2667 land lease authority was used to provide on-post land to a private developer for the construction and rental of housing units to Army personnel for the rent paid from Basic Allowance for Quarters/Variable Housing Allowance (BAQ/VHA) allowances.

Appendix D is a suggested check list that should be used in developing all types of CFF projects. The most important items among these include: ensuring that all possible factors affecting the need for the service from the facility being constructed have been considered, preparing an initial economic analysis, and finalizing the economic analysis using best and final contractor offers. These analyses should use a consistent set of variables that include any opportunity costs to the government for the use of its resources.

801 Housing

Project Need Assessment and Evaluation

By far the largest number of CFF projects completed to date are 801 housing projects. The 801 projects reviewed generally have been beneficial to the government, since they have provided quality housing that meets the needs of installation service men and women. They also appear to operate close to the costs estimated in the economic analyses that compare the life-cycle costs of the 801 project to the MCA alternative. However, since all of the 801 projects were constructed within the past 3 years, it is not yet possible to compare long-term 801 project construction quality with that of MCA.

During the need assessment and project development for 801 housing projects, it was found that many personnel at the installation level felt that the current commuting standard of 30 miles or 1 hour was too long; thus segmented housing analyses using this definition of the available area for housing may overstate the local housing supply. It was suggested that independent standards, tailored to the installation mission, be developed for different areas (i.e., urban versus rural). In rural areas, where an hour's drive may cover 60 miles, the radius would be drawn closer to the base to ensure that, if adequate housing were not closer than 25 to 30 miles, construction of additional housing could be considered.

In cases such as at Fort Ord, where the mission of the Seventh Army Division (light infantry) is to support the Rapid Deployment Force, servicemen must be close to the post. In these instances, the current commuting standard encourages housing choices too far from the post. Since 801 projects will be off

post, it is present Office of the Secretary of Defense (OSD) policy that the government obtain an option on a land site suitable to its needs and close enough to the post to be convenient for service personnel prior to issuing the request for proposal (RFP). All installation-level personnel experienced with 801 projects agreed that this policy is highly beneficial to the government since it avoids the need for evaluation of unsuitable land sites in submitted bids.

Today, with a higher percentage of married enlisted personnel in the Army, more and better quality family housing is needed in order to retain personnel. This need can be met by 801 housing, in many cases faster and at slightly lower cost than MCA construction. In addition, contractors anxious to do business with the government also may be highly sensitive to the housing needs of Army families. During the visit to Fort Hood, it was found that the developer of the Liberty Village 801 housing project (currently completed and operating) had surveyed soldiers to determine their preferences for different types of housing and had learned that detached units with private driveways were the most commonly cited preference. The developer at Fort Hood subsequently reflected this in his plan for Liberty Village, a successful 801 project.

In certain 801 projects, specifications such as road width should be tailored to local climate conditions (e.g., Fort Drum needs extra width for winter snow removal). Poorly designed specs can delay procurement or reduce the quality of life for occupants. In every case investigated, 801 projects were reviewed at a bidder's conference following issuance of the first RFP. It is recommended that this practice be continued, with sufficient time allowed for appropriate amendments to the RFP that reflect the resolution of discussions at the bidder's conferences and consider local factors in project design.

During project need assessment, the source and anticipated cost of utilities (especially water treatment for the proposed 801 project), should be carefully considered. Projects located off post may be located on sites with no supporting utility infrastructure. At Fort Drum, one 801 project contractor entered into an agreement with the local county to build a water treatment facility subsequent to housing contract completion. Construction of that facility was later billed back to the government at substantially higher cost than had been originally anticipated. Other utilities, like sewage treatment and disposal, require complicated permitting processes; their source and probable cost should be considered carefully when selecting an initial site on which to take a purchase option.

Many personnel involved in 801 contracting believe the current OSD policy should be changed to return responsibility for maintenance to the CFF contractor to increase the incentive to do quality construction with low maintenance costs. Further, the current requirement that property be returned to the contractor at the end of the 801 contract period in "as is" condition is likely to mean that developers may not attach as much residual value to the property as they would if they were responsible for maintenance.

Housing projects that were commercially financed by the government in the early 1950s ran into financial trouble because of insufficient provision for transfer of charged maintenance costs to the government, due to inflation.² The structure of the original 801 contract has resolved this problem by providing an escalation of charges based on a standard inflation indicator. If the government retains responsibility for maintenance, it may have more flexibility in deferring certain maintenance costs than if the developer performed regular maintenance and billed the government. However, these considerations

² Harry F. Eng et al., *Facility Acquisition Financing*, NDU/ICAF-86-N48/ADB104280L (Industrial College of the Armed Forces, May 1986), p 14.

are offset by the need to encourage the developer to build a high quality, low-cost maintenance project. Installation personnel at Fort Hood and Fort Wainwright expressed the belief that a contractor who is held responsible for maintenance will be more likely to provide good quality construction.

Bid Solicitation and Evaluation

Current OSD 801 housing program policy precludes the use of on-post land for 801; all future projects will be located off-post. In high-cost land areas, the bids may be too high unless the government provides the land. As was noted in a previous Navy study, if land cost is more than 20 percent of the MCA housing construction cost, an 801 project bid is likely not to be competitive with MCA on a life-cycle cost basis.³ However, an 801 project could compete if the full market value of government land were charged to the MCA alternative, reflecting the opportunity cost of the use of on-post government land in the cost of the MCA alternative. An even better solution would be to make government land with no other high-priority use available for 801 housing. In that case, land value would be about the same in either case; it would be a "wash cost" in comparing the present value of MCA and 801 costs.

Income taxes paid by a contractor upon the sale of an 801 project during or at the end of the contract can also reduce the estimated cost of the project to the government. The government can realize the tax benefit both when the 801 housing project is sold, or when rental is continued to the government or another party, because in both cases, taxes are paid to the government. However, both MCA and 801 projects generate taxes paid to the government; neither has a consistent advantage in this regard.

If calculated correctly, bid limit publication in an RFP helps potential contractors establish feasibility. Bid limit publication has been criticized since it encourages bids close to published maximums. However, in the case of housing, this practice appears to be acceptable since bids are also lower than the established maximum, thus creating savings for the government.

Finally, the comparison of an 801 housing project to MCA ought to reflect the possibility of lease renewal or purchase options which, if exercised, might increase the cost of an 801 housing project relative to MCA over the economic life of the housing, beyond what had been anticipated in the original economic analysis. For example, the life-cycle cost of an 801 project might be higher than MCA if the 801 lease were renewed. This may be true even when the initial analysis for the first 20 years indicated that 801 would be less costly than MCA.

If there is uncertainty over the disposition of the housing assets at the end of the contract, the contracted developer will seek to recover sufficient rent during the first 20 years to fully amortize his debt, meaning that future rentals beyond that 20 years would be added to the original cost of the housing. Therefore, the residual value of the MCA alternative should reflect the economic value to the government of owning housing, and avoiding the need for a lease renewal. This is discussed in more detail below in Economic Analysis Methodology.

Contract Completion and Operation

Visits to 801 housing projects at Fort Hood, Fort Polk, and Fort Drum identified a number of lessons learned pertinent to project completion and operation, from interviewing installation staff involved

³ *Land Prices and Housing Densities for 801 Projects In California* (Naval Facilities Engineering Command [NAVFACENGCOM], January 1989), p 5.

in these projects. It appears that contractors can achieve construction costs approximately 20 to 25 percent lower than what Army analysts had assumed would be the cost of an MCA project, since the CFF contractor is allowed to use more flexible construction specifications than would be allowed for MCA. The comparison between MCA and 801 CFF project alternatives illustrates two different approaches to construction. For example, the contractor for the Fort Hood Liberty Village project was able to place the housing units on shallower concrete slabs than would have been required in MCA, which still appear adequate for housing in that particular area. The project is relatively new, having been completed in July 1988, and the durability of the construction should be more apparent after a period of 5 to 10 years.

The staff who perform initial economic analyses of 801 projects should be aware that, so far, CFF contractors appear to be able to construct housing for 20 to 25 percent less than MCA. Were they to assume a less significant cost difference (for example, only 5 to 10 percent less than MCA was assumed in Fort Lewis and Fort Ord housing feasibility studies), then the initial economic analysis might show that a contractor could not earn an acceptable return on his money using the CFF alternative. After any initial study, a final economic analysis must be performed using the best and final offer from a selected contractor to verify that the present value of 801 housing costs, to which the government proposes to commit, are in fact lower than MCA.

Another lesson learned (based on the experience of Fort Polk) was the importance of completing the entire site infrastructure quickly during periods of good weather. This helps to avoid piecemeal site preparation, and delays in opening houses for occupancy. Projects should be timed to start during the spring or early summer except in climates where good weather prevails year round. This normal construction practice is worthy of note for future project managers to plan the timing for bid solicitation, selection, and contract negotiations, to allow site construction to start in favorable weather.

Phasing delivery of housing completions also helps the 801 contractor to obtain continuous revenues and more quickly amortize debt, thereby reducing interest costs. This current practice should be continued.

Master metering the 801 housing projects also can reduce utility costs, since per kilowatt hour charges often decline with volume. This should be verified by evaluating utility rate structures in each area.

In several 801 projects, the quality of landscaping was poor. This reduced the quality of life for soldiers and families, particularly in common area facilities such as tot lots, baseball diamonds, and family picnic areas. In several cases landscaping has improved, but tighter controls are needed to ensure that the landscaping budget not be shortchanged, even though it is the last component of the project.

The costs for 801 housing projects appear in subsets of the 1940 appropriation account as part of "leased housing," separate from other costs related to government-owned housing. This helps to isolate costs associated with 801 housing leases; this practice should be used for all CFF projects. Since most non-801 leased housing costs occur in Europe, the 1940 accounts in the United States will reflect primarily 801 expenses. If there are other significant non-CFF leased housing costs, then a more specific accounting classification should be established to differentiate 801 housing costs.

Finally, it is current practice to provide an annual incentive award to the developer who manages the 801 housing projects, of up to 5 percent of annual maintenance costs (Note: since maintenance costs will now revert to the government, the basis for this incentive award in future contracts must be identified). The level of incentive award is determined by a point system based on a survey of the quality

of life and service in the 801 housing project by the residents. The incentive motivates the developer to satisfy residents and resolve complaints more quickly; this award should be continued for existing projects. Its success in future projects should be assessed to see which contractors (CFF, maintenance, or both) should be eligible for the award.

In the past, many 801 projects have spanned much time from initiation to contract completion. Different people are involved from project need assessment to bid solicitation, evaluation, and contract negotiation. For example, the initial assessment of housing needs using the DOD segmented housing analyses may be done by one person, the development of specifications by another, and contract management done by still another group of installation and district staff. This is understandable, as different levels of expertise are needed for various stages of project development. To ensure continuity of knowledge about particular projects and about the entire process, a team of Army 801 housing experts should be created to advise and work with installation personnel throughout the process. This would help to improve knowledge of project requirements, to tailor requirements to the needs of particular areas, and to consolidate the experience and knowledge of the developers with whom the Army has done business in the past.

Using a team of housing experts would allow installation personnel additional time to balance project work with their primary responsibilities. Several installation-level personnel with 801-project experience stated that it is difficult to balance this combination of responsibilities.

802 Housing

The 802 housing projects that have been planned have not been completed, and the interviewed installation personnel do not view the program as successful. As with other housing projects, 802 is needed when a local housing shortage exists and/or BAQ/VHA allowances are below local market rental rates. In such cases, sufficient incentives for the developer to build new construction do not exist because the rents paid by service men and women from BAQ/VHA are not high enough to cover the costs of bringing new units to the market and operating them. The rental agreement is a percentage occupancy guarantee (97 percent) with rent directly paid by servicemen from BAQ/VHA. Many contractors and their potential lenders are not interested in 802 projects where the rent would be limited to BAQ/VHA allowances plus a contribution by the tenants.

Therefore, the 802 program does not attract many contractors, and even when contractors have expressed an interest, as at Fort Hood, the agreement has failed before completion from lack of financing. The contractors cannot obtain financing apparently due to the low rents and the perception that direct payment by renters is a less acceptable credit risk than rent paid in a lump sum directly from the government to the developer.

As a result, 802 projects have been canceled after extensive time and work by the Army. People at the installation level consider the 801 housing program more desirable because it covers the cost of bringing new rental units to market.

2667 Land Leases

Project Need Assessment and Evaluation

The 2667 land lease program originally was developed for the leasing of underutilized government land to commercial entities for a variety of purposes. In the projects at Fort Ord and Fort Hunter Liggett, the land was leased at nominal cost (\$1.00) to private contractors in consideration for their building and renting housing directly to military personnel. The performance of the 2667 land leases at Fort Ord has been a function of location and long-run local housing demand. For example, the Thorson Village project at Fort Ord is a highly attractive housing development built in a prime location on government land. If subsequently sold by the government to the contractor at the end of the lease, the land would be readily marketable in the local real estate market.

The opposite is the case at Fort Hunter-Liggett, where insufficient demand exists for the housing units, since a planned expansion of that installation did not occur. The 2667 land leases at Fort Ord and Fort Hunter Liggett also provide for occupancy by noninstallation personnel in the event of vacancies. Moreover, the strong local housing demand around Fort Ord tends to reinforce the developers view of a good long-term market for rental occupants. However, the 2667 leases are ultimately limited by the availability of underutilized land.

Bid Solicitation and Evaluation

The 2667 land lease contract with the developer should be analyzed to determine its life-cycle cost to the government (i.e., payment of BAQ/VHA allowances) relative to construction of MCA housing on post. Unless there are substantial differences in MCA versus 2667 on-post land sites, land acquisition costs presumably will be a wash cost.

Potential private contractors usually are more interested in 2667 land lease projects than in 802 housing. This probably is due to: (1) provision of land by the government for a nominal fee, (2) avoidance of state impact fees (\$1.8 million at Thorson Village), (3) provisions for rent escalation (from 4 to 8 percent per year in the case of the Brostrom and Thorson Village projects at Fort Ord), and (4) access to the project by civilian renters if units are vacant for 30 days or more. The attractiveness of the 2667 projects can be further enhanced by allowing the developer to add other revenue-producing facilities such as storage facilities and recreation clubs to the property. These fee-generating commercial facilities could lower costs of contractors, especially given the nominal cost of land. Some of these cost reductions might be passed onto Army personnel through lower rents. However, the Army and Air Force Exchange Service (AAFES) apparently opposes this; their opposition must be addressed before further progress can be made in realizing the benefits of these fee generating facilities.

Contract Completion and Operation

The 2667 land leases in place at Fort Ord can be transferred to another party with the approval of USACE. Should that be decided, the qualifications of new owners will be reviewed and the approval controlled by USACE. This practice should be continued.

The projects at Fort Ord allow civilians to rent those units not yet filled by referrals from DEH, that have been vacant for 30 days. However, these rentals can be canceled on 30 days' notice to make housing available for military personnel and other DOD employees. Rental to civilians should be avoided until all the family housing needs of installation personnel are satisfied. As in the case of 801 housing, master

metering the electricity for the entire 2667 land lease housing project might reduce per unit costs per kilowatt hour. However, since individual tenants currently are responsible for payment of utilities to the developer, the master meter bill would have to be further allocated to individual meters. This alternative should be examined in future projects to see if the costs of individual metering behind the master meter are offset by utility savings. In these cases, the developer probably would have to pay for the connection from individual meters to the master metering point, to allocate bills to individual residences, an expense which might not be justified.

Apparently, no performance bonds were posted for the reviewed 2667 projects, but there was a penalty for the late delivery of units. This imposed the risk on the Army that contractors may not have finished projects on schedule. The Army would not be liable for costs, but it might not receive the housing when it is needed, thereby imposing an additional cost of temporary housing. Contractors should be required to post proposal and performance bonds to ensure that Army housing needs are met.

2809 Facilities

Not enough 2809 CFFs have been developed to draw firm conclusions. Apparently, for the projects that currently are planned, CFF is used as an alternative because MCA funds are not available. However, this program should be used selectively because it may be expensive relative to MCA unless used for facilities with size and operating costs large enough to allow for the benefits of private service economies.

Many Army officials believe that 2809 CFFs provide a service at lower cost to the government than construction and operation of MCA because private labor costs are lower. These costs should be analyzed on a project-by-project basis. Unless there is sufficiently different construction design flexibility, and/or a private contractor's operating labor force has a lower wage structure, it is unlikely that the net present value of costs of these facilities can be competitive with government-constructed and operated facilities. Moreover, the potential development of these projects may be opposed at the installation level on the basis that private contractors replace civilian government jobs.

A further problem with 2809 facilities leases is that they may be perceived by the IRS as "installment sales" rather than "leases" under the tax code if they satisfy relatively unique requirements and are located on post. If so, they may be viewed as "limited-use property," weighing in favor of an installment sale interpretation. The actual ruling of lease versus sale is made by the IRS on a case-by-case basis by a number of criteria. However, without the tax benefits associated with a lease contractors will be less willing to participate or will want to charge higher rents.

2394 Energy Supply

Commercially financed energy heat supply facilities contracted under section 2394 generally are larger, more capital-intensive projects. For example, the capital cost of the Fort Drum energy plant, including a facility for cogeneration, cost nearly \$100 million, much more than the average cost of approximately \$12 to 15 million per 300-unit 801 housing project. Generally, 2394 heat supply contracts run for 25 years, including a construction period of approximately 2 years. In most cases, there is an option to renew the project at the end of the contract. These projects are developed when there is an additional requirement for thermal energy due to a change in mission or when an existing boiler is being replaced. In the case with Fort Drum, there was a need to replace an old central heating plant as well as

to support an expanded mission. In the case of Aberdeen Proving Ground, alternative thermal supply cost less than the oil and operating costs of an existing plant.

Because of the complexity of heating plants and of the related engineering standards, it may not be as easy for CFF contractors to reduce the construction costs of these plants below their MCA equivalent. The principal lesson learned from 2394 energy supply contracts is that contractors need sources of revenue from the project in addition to the revenues from the sale of thermal energy to the government to achieve their return on capital.

Energy supply projects usually are financed with a significant percentage of debt (approximately 70 percent debt as a percent of total capital in the case of the Fort Drum project). Experience suggests that investors use target rates of return of at least 20 percent for nondebt capital invested in such projects. Additional sources of revenue available to contractors to meet these return expectations include the sale of electricity, cogenerated with heat, back to the local electric utility grid under the provisions of the 1978 Public Utilities Regulatory Policy Act (PURPA) and/or tipping fees in the case of waste energy projects. (Tipping fees are fees paid to the project owner by local municipalities for the disposal of trash through incineration.) These fees effectively lower fuel costs.

Project Development

The largest 2394 energy project completed and now operating is the Fort Drum plant, which was structured by the contractor to also provide thermal energy to Fort Drum and capacity for sale of up to 49 megawatts of electric power under contract as a qualified facility under Federal Energy Regulatory Commission (FERC) rules to Niagara Mohawk, the local utility. A review of the experience at Fort Drum indicates that because of the ultimate cost of the contracted energy, some of the nonappropriated fund facilities at Fort Drum are considering satisfying their own utility needs through alternative boilers and/or electrical generation in their buildings. If they do so, the thermal requirement and consequently the capital cost and size of the facility will have been too high relative to long-term needs.

A more thorough analysis of potential growth and long-term thermal requirements is needed before setting project specifications, particularly capacity. A review of the potential for conservation to reduce thermal load requirements, especially peak requirements during winter months should be a mandatory part of an overall installation energy plan that precedes specifying a new central heating plant. The costs to achieve a lower thermal requirement through conservation should be cost effective relative to the estimated cost of purchasing additional thermal energy supply.

Two other thermal energy contracts, at Aberdeen PG and Redstone Arsenal, involve waste energy facilities. Waste incineration energy projects currently are in demand, particularly in large urban areas, due to the increasing scarcity of trash landfill sites. Municipalities enter into contracts with developers and operators of waste energy facilities to incinerate city trash in return for a payment of tipping fees. Use of waste from an installation also could eliminate tipping fees paid by the installation and the avoided fees could be credited to lower net energy costs from the facility. At Aberdeen Proving Ground, the cost of thermal energy supplied from oil burning was reduced through a contract with a waste burning facility developed as part of a county authority that financed the project with lower interest, tax exempt bonds. The contract uses tipping fees to reduce the net cost of thermal energy production.

The current thermal energy costs and requirements at installations in large urban areas should be examined carefully. Demand for trash disposal facilities is high in these areas and thermal energy supplied by a waste incineration facility in such areas could be a cost effective energy alternative for the Army.

CFF central heat plants other than waste incineration facilities are likely to be successful only if the plant cogenerates power that can be sold to local utilities that have relatively high avoided costs. Avoided cost is defined as the cost of both energy and capital that a utility requires to produce an additional unit of electricity. Generally, this cost is established as part of a utility's long-term resource planning process and is based on the cost of the most efficient mix of resources to generate future electric requirements.

Therefore, in areas where electricity is in short supply, avoided costs may be high enough to add additional revenue that will exceed the incremental cost of configuring an energy plant to cogenerate electricity and steam or high-temperature water that would be supplied to the government. In these cases, the incremental profit from the sale of electricity can be used to reduce the cost of thermal energy to the government and allow the facility to compete on a present value cost basis with a government-owned and operated plant. However, larger sites are needed for cogeneration plants, and in some cases, the contractor also would have to build the connection to the utility transmission and distribution system. The potential for profitable CFF cogeneration plants is likely to be highest at installations in regions of the United States where additional generating capacity is needed. These include New England and the Middle Atlantic States where, until recently, economic growth has exceeded the expectations of utility planners, producing a need for new capacity.

Because the development of CFF energy projects requires special skills, expertise for identifying and evaluating them has been centralized in the Huntsville Division. Centralizing expertise is widely regarded by developers and others within the Army as a good model for supporting the design, evaluation, and contracting for other types of CFF facilities. Time and money could likely be saved if similar expertise were made available for other CFF projects on a regular basis.

Bid Solicitation and Evaluation

Design and construction of central energy plants requires complex engineering and design, as well as construction management. The Army should seek experienced bidders first and prequalify them to avoid awarding contracts to inexperienced bidders who produce poorly designed or built facilities that cannot be operated reliably. A short list of bidders should be developed for each project based upon their experience in successfully developing and operating similar projects for Army and non-Army customers.

At present, it also seems likely that gas-fired cogeneration plants would provide the lowest life-cycle costs for all but the very largest thermal loads relative to coal.⁴ This cost advantage could change in the future if relative fuel prices or emission standards change. These relationships should be monitored closely by staff responsible for the economic analysis of these projects. It also would be prudent for the Army to solicit plants with fuel switching capability, where possible, to reduce the risk that shortage of a single fuel could cause higher fuel costs and/or supply disruptions.

Contract Completion and Operation

The number of contracts awarded for central heat supply has been limited because contractors have not been able to earn sufficient additional revenues by selling cogenerated electricity to make the projects profitable for them. Because of continued constraints on the availability of funds for replacement or new central heating plants, the government should consider revising its policy against military use of

⁴ Alan M. Cody and Gary W. Schanche, *Economics of Third-Party Central Heating Plants to Supply the Army*, USACERL Draft Technical Report (November 1988), p 37.

cogenerated electricity in order to give developers additional revenues. Payments for this cogenerated electricity likely would be higher than local area utility avoided costs since the government would pay for this electricity on the basis of its own avoided retail costs of electricity, less whatever charges it must pay for backup electricity from the local utility.

The Army also should try to avoid indemnifying contractors for financial risks that they should be willing to bear in return for the expectation of higher financial returns on projects. The practice should be to allow reasonable transfer to the contractor of cost escalations due to inflation in operating costs such as labor, maintenance, and fuel, but not for cost increases due to special case legislation such as the 1986 tax law. Understandably, this tax reform act created financial uncertainties for contractors; however, guaranteeing a continued high rate of return for future tax law changes is not in the Army's interest.

The current energy contract for thermal energy supply used at Fort Drum includes provision for escalation of fuel costs based on: (1) a formula tied to the rate of change in inflation indices for the type of fuel used by the plant and (2) escalation of all remaining costs aggregated as a fixed capacity charge. This capacity charge includes both capital recovery and cash operating costs and is *not* an appropriate base to cover actual cost increases experienced by the contractor due to inflation.

For example, the contractor's depreciation charge on his income statement is a noncash cost; it is an amortization of the construction cost paid at the beginning of the project and is not affected by future inflation. Arguably, the rate of return on capital should reflect the impact of inflation; however most developers anticipate this in their initial financial analysis and target a rate of return that compensates them both for expected general inflation and the risk of unanticipated changes in inflation.

Therefore, the contract structure used at Fort Drum should be modified in future procurements to separate the capacity charge into capital and operating cost components. Only the operating cost components should be escalated to reflect inflation (as was done in the Redstone Arsenal contract with a waste energy facility). This would align contractor recovery of cost inflation from charges to the Army with changes in his costs that he is in fact likely to have incurred. This would limit the exposure for the Army to the impact of unanticipated future inflation that currently is applied to a capacity charge that includes capital and noncapital cost components.

Finally, exceptions to the Federal Acquisition Regulations (FAR) were needed for the development of the waste energy facility at Aberdeen Proving Ground. These included contractual exceptions to allow the removal of vegetation, and guarantee of debt service in the event the government might cancel the project. To the extent that these exceptions can be anticipated (and it appears they can), a more standardized contract that reflects these FAR exceptions should be developed.

Debt guarantees, sometimes necessary to obtain financing, commit the government to a long-term obligation and appear to conflict with the intent of Congress to make these contracts subject to annual appropriations. For example, at Aberdeen Proving Ground, the contractor was guaranteed payment of the outstanding debt in the event of contract cancellation.

3 ECONOMIC ANALYSIS METHODOLOGY

Overview

To review the methodology for economic analysis now used for CFF projects, a number of economic analyses prepared for specific projects and installations including those for Fort Hood, Fort Lewis, Fort Ord, and Fort McCoy were examined. These analyses primarily were evaluations of 801 housing projects costs as compared to MCA. Several were general analyses of alternative Army family housing (e.g., 802, BAQ/VHA, and 2667 outleases of land for housing development). Reviewed were the analysis of energy costs for the Aberdeen PG and Redstone Arsenal thermal energy contracts, the USACERL technical report, *Economic Analysis: Description and Methods*,⁵ OMB Circulars A-94, *Discount Rates To Be Used in Evaluating Time-Distributed Costs and Benefits*, and A-104, *Evaluating Leases of Capital Assets*, and Army Regulation 11-28, *Economic Analysis and Program Evaluation for Resource Management*.

This review indicated that the methodologies being used are sound because:

- They focus on cash and opportunity costs to the Army when incurred.
- They adjust for the time value of money expended depending on the actual timing of costs.
- The analysis focuses on cost differentials among alternatives excluding wash costs.
- The basis of comparison and selection of the least-cost alternative is net present value, which is appropriate.

Although the methods were sound, they have been applied in different ways across different projects (Table 1). Table 2 shows that, in selected housing project analyses, specific variables were not always consistently included, even in the economic analyses of the same types of CFF projects. This inconsistency throws the results of the analyses into question, since several of these variables (e.g., land acquisition cost for MCA, insurance, taxes and payable increases, and the residual value of MCA housing) would have a significant impact on life-cycle costs. Figure 1 illustrates the relative contribution to the total present value of project costs of each cost component for MCA and 801 estimated in the economic analysis of Fort McCoy's planned 801 housing project. The consistency of variables included in the analyses appears to have improved, in part due to more specific guidance that only off-post 801 sites will be allowed and also due to clear documentation of economic analysis methods in USACERL TR P-89/08.

It is common practice in financial analysis to include opportunity costs (i.e., use of installation land in MCA) in a project analysis.⁶ In some cases, this was not included since both alternatives were on post; in other cases, it appears to have been omitted. While in theory, all tax benefits and cost effects to the government also should be considered, it is probably not practical to assume these could be estimated easily.

⁵ R.D. Neathammer and J.D. McLean, *Economic Analysis: Description and Methods*, TR P-89/08/ADA204264 (USACERL, December 1989).

⁶ Richard A. Brealey and Stuart C. Meyers, *Principles of Corporate Finance* (McGraw: New York, 1988), pp 93-115 includes a thorough discussion of proper investment decision making using net present value analysis.

Table 1
CFF Project Economic Analysis

Variables	801 Housing	802 Housing	2394 Energy	2809 Facilities
Significant Cost Variables	Shelter rent Payable real estate tax increases	BAQ/VHA allowances	Annual capacity charge Fuel costs	Annual rent Annual service contract cost
Maximum Length of Contract/Lease	20 years	25 years	30 years	32 years
Impact of General Inflation	Included	Not included	Not included	Included
Discount Rate Used	Current treasury bond yield + 1/8%	10%	10%	Current treasury bond yield + 1/8%
Applicable Policy Guidance	OMB A-104	AR 11-28	AR 11-28	OMB A-104

Discount Rates

The discount rates used for economic analyses of leases were inconsistent with those used for nonleases. For leases, OMB Circular A-104 specifies that costs for each alternative in the analysis should be projected with inflation, i.e., in current dollars, and discounted at a rate equal to the current nominal yield on a U.S. treasury debt instrument plus an eighth of a percentage point to reflect government agency borrowing costs. However, Army regulation 11-28 specifies that for nonlease projects such as energy projects, costs should be projected without general inflation, i.e., in constant dollars, and discounted to present value using a 10 percent discount rate.

For an analysis to be consistent, constant dollar costs should be discounted at a real (inflation-adjusted) rate. The real discount rate for projects financed by government borrowing is currently much less than 10 percent. For example, the current yield on treasury bonds with 20 years to maturity is about 8 percent.⁷ The current inflation rate in the economy is about 4.5 percent, making the real cost of government borrowing about 3.8 percent.

However, OMB Circular A-94 (1972) established as a matter of policy that the discount rate should reflect the inflation-adjusted opportunity cost of investment in the private sector. Even though the specified rate of 10 percent is intended to be the opportunity cost of government borrowing compared to

⁷Wall Street Journal (15 November 1989).

Table 2

Selected CFF Economic Analyses of Housing Projects

Economic Variables	Fort Lewis	Fort Hood	Fort McCoy	Fort Ord	Fort Polk
Land Acquisition Cost for MCA Project	801	802	801	802	801
Imputed Insurance Cost for MCA Project			X*		
Imputed Real Estate Tax for MCA Project			X	X	X
Capital Gains Taxes Contractors Would Pay to Government if Purchase Option Exercised			X	X	X
Residual Value of MCA Facility	X	X	X	X	X

*X indicates variable included in analysis.

private sector investments, the 10 percent rate will not always remain current, since private sector returns on capital vary, and the 10 percent rate has not been changed since 1972.

The analytical methods used for present-value calculations for leases and those used for other CFFs therefore use inconsistent discount rates. Moreover, the high real discount rate specified by AR 11-28 may reduce the present value of future CFF payments more than it should relative to MCA, if the opportunity cost to society of public sector spending is lower now than it was presumed to be in 1972.

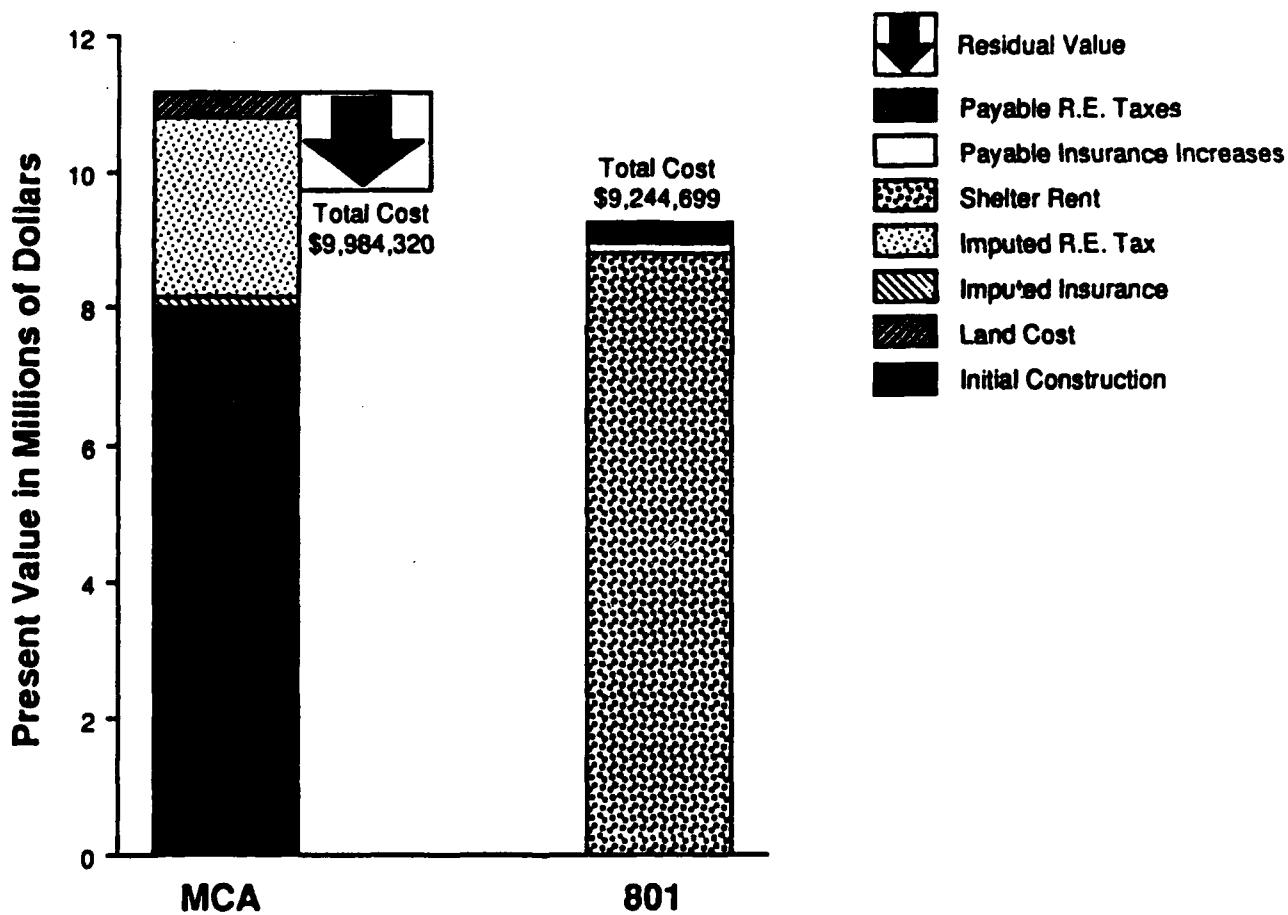


Figure 1. Relative present value of costs of military housing alternatives at Fort McCoy, WI.
(Source: Economic Analysis for Providing 80 Units of Section 801 Military Family Housing at Fort McCoy, WI, ADL analysis; Assumptions: 21 years analysis period; 9.5 percent discount rate; OMB/OSD inflation rate guidelines.)

Inflation Assumptions

Currently, OMB/OSD policy requires the use of inflation guidelines (Table 3) for CFF economic analyses that include the effect of inflation on costs (i.e., leases).

Table 3

OMB/OSD Inflation Guidelines*

Fiscal Year	Inflation Rate (%)
1989-90	3.6
1990-91	3.3
1991-92	2.8
1992-93	2.3
1993-2010	1.8

*Source: PBC memo 88-374 dated 28 June 1989.

According to the 1989 *Report to the President of the Council of Economic Advisers*, inflation, defined as the annual percentage increase in the implicit GNP deflation, has averaged 4.6 percent from 1980 to 1987. While forecasting future inflation rates (especially for 20 years) is an imperfect science, recent experience indicates that the assumed decline to a sustainable 1.8 percent inflation rate is optimistic.

A higher general inflation rate affects the relative present values of MCA/801 costs estimated in the economic analysis in the following ways:

- It raises the annual payments to the 801 contractor for payable insurance and real estate tax cost increases
- It raises the estimated MCA residual value because the estimated initial construction cost is inflated to a current dollar value at the end of the analysis period prior to applying the site appreciation and building obsolescence factors specified in OMB Circular A-104
- It raises the estimate of imputed real estate taxes for MCA
- It may create underfunded 801 projects (and other CFFs).

Using lower inflation rate guidelines may underestimate the cost reimbursements that will have to be paid to the CFF contractor for insurance and property tax increases, and may underestimate the residual value of MCA housing (a negative cost credited to the MCA alternative). This may bias the analysis toward the CFF alternative. It also may underestimate the cost of service by the Army to MCA housing residents as reflected in the imputed real estate tax cost estimated for the MCA case.

MCA Residual Value

A problem the analyst faces in computing the relative costs of MCA and a CFF such as an 801 housing project is that the periods of expenditure commitment for the two types of housing are different. Once built, MCA housing has an economic life of 40 to 45 years, while an 801 housing contract makes a firm commitment to lease for only 20 years. Thus, without allowing for possible additional 801 rental costs from years 21 to 45, the analyst might project MCA housing to be more costly. The standard approach to this problem in financial analysis is to calculate the present value of each asset or rental agreement over its life (even if the lives may be different) and calculate an equivalent uniform annual cost using present value annuity factors.

OMB Circulars A-104 and AR 11-28 do not allow the use of equivalent uniform annual costs as a selection factor among project alternatives. Because of the long time periods involved, there also is a possibility of significant changes in the cost of obtaining further use of non-MCA housing after the end of the initial 801 contract. This would make the equivalent uniform annual cost method less useful, since it presumes that the present value of rental renewals would not change. Therefore, a better estimate of the residual value of MCA housing that reflects the benefits of avoiding non-MCA housing costs following the initial contract term is needed in order to use net present value analysis to select the least-cost alternative.

The principal value of MCA housing relative to the 801 alternative is that it is government-owned housing, obviating the need for lease renewals, payment of BAQ/VHA housing allowances, or project purchases after 20 years. Since 801 projects now all will be located off-post, project purchase costs are not as relevant as when projects were on-post. It also is possible that the government will not have a need for the housing in 20 years (due to installation closures or force cutbacks). In this case, the MCA construction cost (adjusted for inflation, site appreciation, and building obsolescence as specified by OMB Circular A-104) would be a more relevant factor as an estimate of residual value (in practice an appraiser of the value of real estate property would consider both its adjusted construction cost and present value of operating income from rents).

Thus, the MCA residual value in year 20 of an economic projection of MCA costs relative to 801 should be an average of the economic value of BAQ/VHA allowances, 801 rental renewal costs avoided by having MCA housing and the adjusted cost of the building and land. This approach has the benefit of properly crediting to MCA an average of reasonable estimates of costs avoided under all possible scenarios for Army housing needs in year 20.

The following example illustrates this using the data prepared for an August 1989 analysis of 801 housing at Fort McCoy. The residual value of MCA housing calculated using OMB circular A-104 guidelines was \$8,038,104. If, on the other hand, this value had been calculated as the present value (in year 2010) of the cost to the Army of continued rental of the housing for 25 additional years at a cost per year equivalent to the initial rent but inflated to year 2010 dollars using existing OMB/OSD inflation guidelines, the value would be \$14,301,215. As a third alternative, the Army could calculate the present-value cost of an additional 25 years of BAQ/VHA allowances after the end of the contract. This would be a realistic value if adequate housing supply existed in the local market precluding the need for Army family housing. Neither actual needs for housing nor the adequacy of the local market in meeting them 20 years hence is likely to be obvious. Therefore, the Army should require calculation of an average of all three alternatives for use as an MCA residual value in judging whether 801 is least cost (see Figure 2). Figure 3 illustrates the results of the same calculation of MCA residual value using an inflation rate assumption of 4 percent rather than the current OMB/OSD guidelines.

Figure 4 summarizes the impact on relative present values of costs for housing alternatives at Fort McCoy under alternative inflation rate assumptions and MCA residual value estimation methods. Case I is a restatement of the costs originally estimated in the Fort McCoy economic analysis assuming inflation of 4 percent/yr rather than existing OMB/OSD guidelines. Cases II and III illustrate the impact on relative costs using the estimates of MCA residual values discussed above under OMB/OSD and 4 percent/yr inflation assumptions.

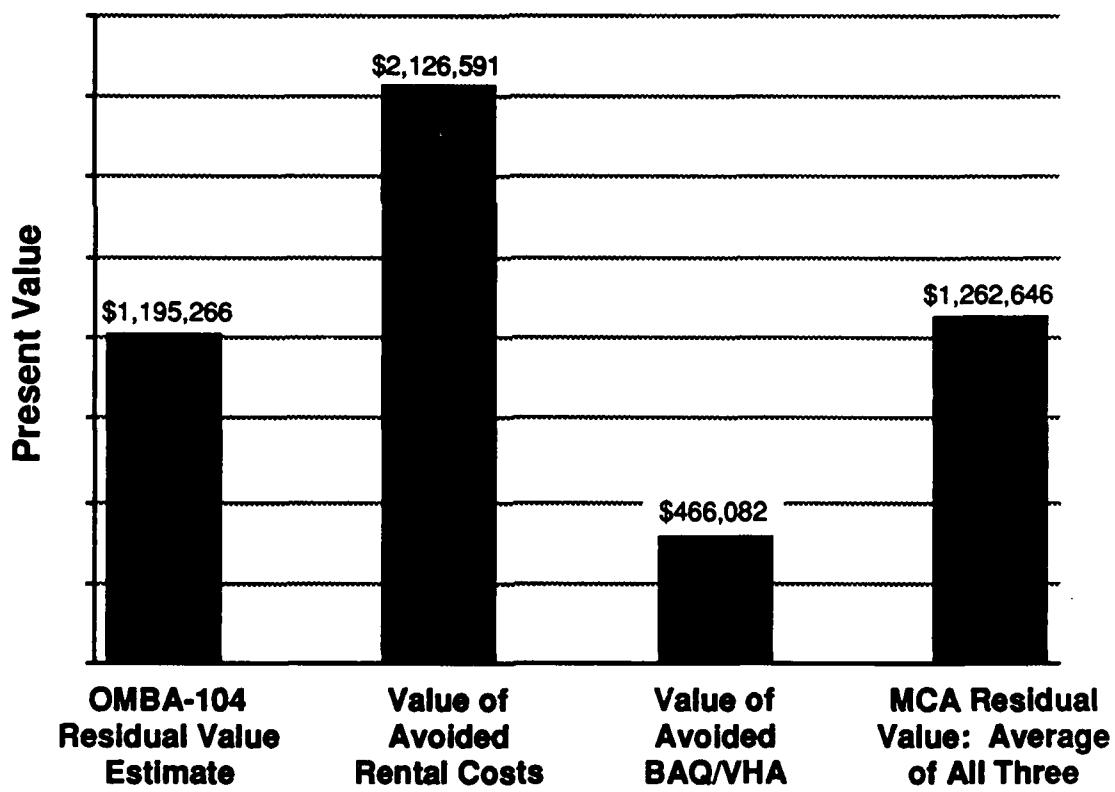


Figure 2. Alternative MCA residual values for Fort McCoy. (Source: Economic Analysis for Providing 80 Units of Section 801 Military Family Housing at Fort McCoy, WI; ADL analysis; Assumptions: OMB/OSD Inflation Guidelines, BAQ/VHA allowances are average for Army enlisted personnel.)

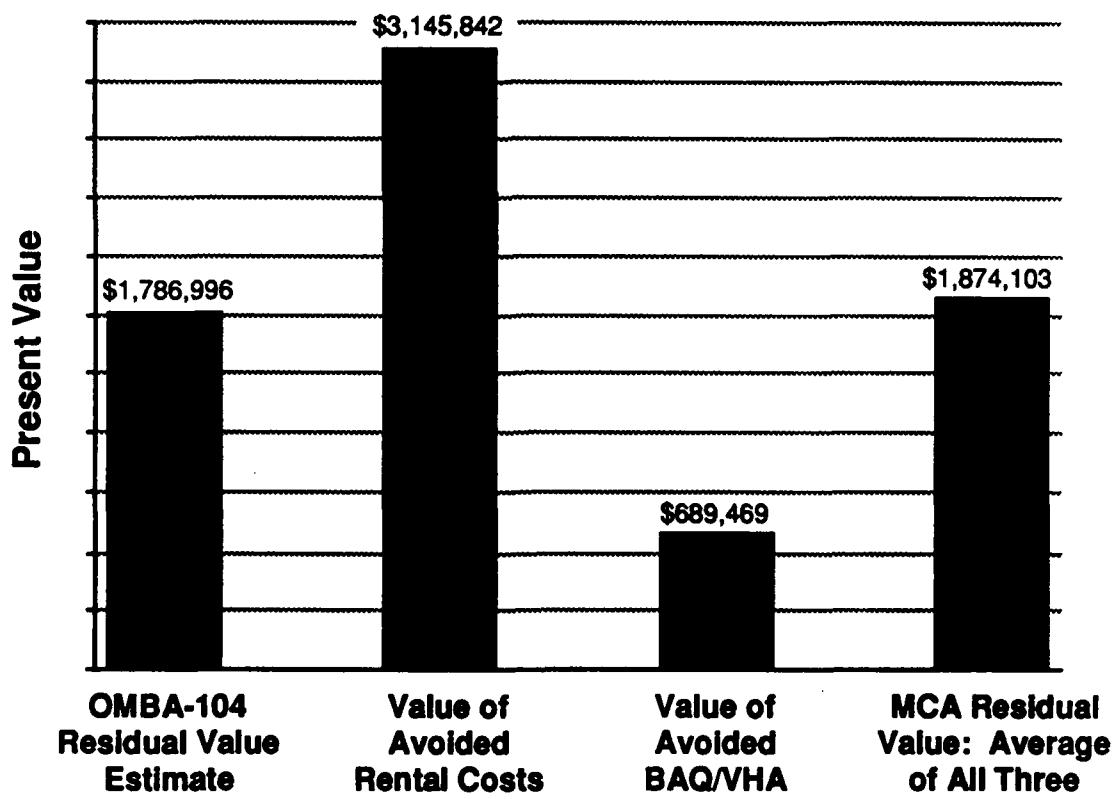


Figure 3. Alternative MCA residual values for Fort McCoy using an inflation rate of 4%.
 (Source: Economic Analysis for Providing 80 Units of Section 801 Military Family Housing at Fort McCoy, WI; ADL analysis; Assumptions: 4%/year inflation, BAQ/VHA allowances are average for Army enlisted personnel.)

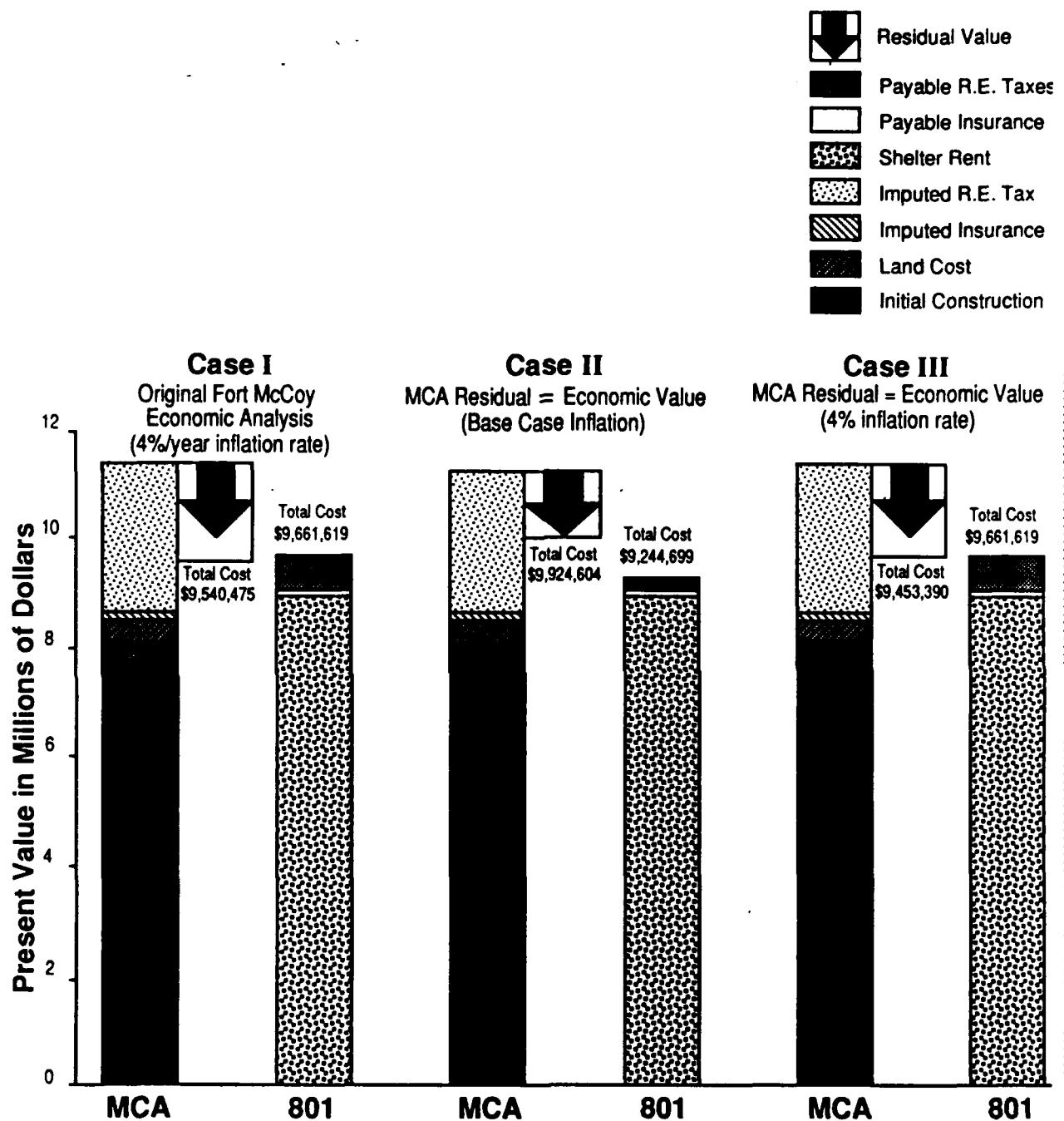


Figure 4. Impact of different assumptions on relative present values of Fort McCoy housing alternatives. (Source: Economic Analysis for Providing 80 Units of Section 801 Military Family Housing at Fort McCoy, WI; ADL analysis; Assumptions: the MCA residual value in Cases II and III was estimated as the average shown in Figures 2 and 3 respecting conclusion of initial lease.

4 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Although the Army has only a few actual CFF projects in place, several aspects of project performance and feasibility are evident:

1. Contracts under the 801 housing program often provided housing faster and at a slightly lower present value of contract costs than the present value of MCA was estimated to have cost if built. The lower present value of costs are apparently due to lower construction costs because private contractors are allowed to employ somewhat more flexible design specifications than MCA.
2. The 802 housing program appears to be infeasible because, even with the rental occupancy guarantees, the BAQ/VHA payments used by service men and women to pay rent are usually below levels needed to make new construction profitable.
3. Section 2394 thermal energy contracts appear to be economical when structured as energy service contracts with waste energy facilities financed by tax exempt bonds or as part of a cogeneration facilities in geographical areas where utilities would make avoided cost payments for electricity in accordance with the Public Utilities Regulatory Policy Act high enough relative to costs to justify investment by private parties.
4. No conclusive evidence of the success or failure of the 2809 facilities program was revealed because, to date, there have been no successfully awarded or completed 2809 projects.
5. There was no conclusive evidence of the success or failure of the new 2812 facilities program (established by legislation passed by Congress in November 1989), since this program was not researched in this study.
6. Developers have difficulty financing projects without noncancellation or debt service guarantees that may reduce the Army's flexibility in allocating resources because of termination obligations and because the Army does not own the facilities involved.
7. CFF contracts which maintain a lessor tax status for contractors rather than installment sale status reduce the willingness of contractors to participate due to less favorable timing of taxes due.

Commercial financing of facilities has enabled the Army to obtain services from the use of facilities that might not otherwise have been available given current limitations on funding for MCA construction. However, continued use of commercial financing for facilities has long-range implications for the Army budget. The informal and, in some cases, formal guarantees given to contractors that the government either will not cancel a CFF project or will guarantee the service of debt, as is the case with the energy project at Aberdeen Proving Ground, may reduce the long-term flexibility of the Army to adjust its budget commitments to actual requirements.

Under current rules, CFF contracting is beneficial to the Army primarily in two cases. One cost advantage accrues when the contractor can achieve significantly lower (at least 15 to 20 percent) construction costs than what the Army could achieve in constructing a similar facility. A second benefit

occurs when a single facility generates additional revenues while still meeting the service needs of the Army, as in the case of energy plants that supply steam or hot water to the Army, and also cogenerate electricity for sale to the local electric grid.

For nonlease projects, use of a high discount rate may lead to Army funding of facilities with future payments discounted at higher rates than the current inflation-adjusted opportunity cost to society of government spending. There is also an inconsistency in the discount rates cited in OMB Circulars A-94 and A-104. The use of the low inflation rate of approximately 1.8 percent also risks underestimating the actual future costs of CFF facilities. The MCA residual value should be an average of the OMB A-104 residual estimate (cost based) and of the economic values of not having to renew an 801 lease and the value of not paying BAQ/VHA allowances.

Recommendations

General

To improve its management of CFF projects and to increase the probability of success of CFF projects with life-cycle contract costs actually less than those of MCA, it is recommended that the Army:

1. Establish centers of project-specific expertise for all types of CFF projects that can work with installation personnel to ensure continuity of project development management
2. Establish and require that a consistent set of cost variables (e.g., imputed land, insurance and property tax costs, along with construction costs in the case of MCA housing) be used for all MCA-CFF life-cycle cost comparisons
3. Review the discount rate specified in Army regulation AR11-28 to ensure that it is consistent with the current inflation-adjusted opportunity cost of government spending, i.e., the return to society that would have been earned in the private sector, and with OMB Circular A-104, since both cover long-term contracts for services from facilities built and owned by private contractors (The choice of a proper discount rate should be taken up by OMB in concert with the Joint Economic Committee of Congress.)
4. Eliminate guarantees that the government will indemnify a contractor for cost risks that a contractor normally would be willing to bear in return for higher than average expected financial returns
5. Establish appropriation codes to collect the costs of CFF facilities separately from other installation operating costs
6. Continue to hold bidders conferences so that all possible project contingencies are clarified to allow bidding on a consistent basis by all private developers
7. Thoroughly screen and evaluate all bidders, especially in the case of energy projects, before allowing them to bid
8. Perform present value cost analyses in every case prior to the award of a bid, to ensure that the net present value of costs of the best and final offer continues to be enough lower than MCA to justify CFF.

Project Specific Recommendations

Several changes should be made in existing CFF project programs to improve the contribution of CFFs to the Army's mission:

1. The current OSD policy of retaining government responsibility for maintenance of 801 housing projects should be reviewed in light of the strong belief by some installation, Corps of Engineers, and private sector personnel, that CFF contractors provide better quality construction that lowers long-term maintenance costs in contractor-maintained housing. This review must weigh the benefits of contractor-maintained housing against the greater ability of the Army to control the timing and cost of maintenance in government-maintained housing.
2. 801 housing projects should be allowed on post to reduce cash costs in high-cost land areas and to reduce the commuting costs of military personnel, provided that the fair market value of those sites is included in the comparison with costs of an off-post 801 project, and that flexibility is preserved for the government to retain the land and/or choose the most cost-effective option for housing at the end of the lease. This was done with 2667 outleases of land at Fort Ord; it would seem that the ownership consequences of on-post 801 projects are reasonably similar to 2667 land outleases.
3. Since the 802 housing program is currently infeasible and all such projects have been canceled after time and expense costs to the Army, the program should be restructured or abandoned.
4. Contracts for the purchase of energy from waste energy facilities should be standardized to avoid continual requests for FAR waivers known to be needed in advance.
5. Quality assurance of project construction must be increased, since CFF contractors attempt to achieve annual costs (i.e., net present values lower than MCA) by building more quickly and cheaply.

APPENDIX A:

DOCUMENTS REVIEWED

CFF Legislation, Title 10, USC

Section 2394, "Contracts for energy or fuel for military installations."

Section 2667, "Leases: non-excess property (real property)."

Section 2809, "Test of long term facilities contracts."

Section 2821, "(802) Rental guarantee (housing)."

Section 2828, "(801) Build to lease (housing)."

Policy Guidance

9/9/87 DOD update to DOD 801 Housing Program (build to lease).

Management Plan for Third-Party Contracting/Alternative Financing for Energy or Fuel for Military Installations, HND 1115-3-22, Revision A (U.S. Army Corps of Engineers, Huntsville Division, December 1985).

Neathammer, R.D., and J.D. McLean, *Economic Analysis: Description and Methods*, Technical Report P-89/08/ADA204264 (USACERL, December 1988).

OMB Circular A-104, *Evaluating Leases of Capital Assets* (01 June 1986).

OMB Circular A-11, *Preparation and Submission of Budget Estimates* (17 June 1988) (Preparation of FY 1990 budget submissions).

OMB Circular A-94, *Discount Rates To Be Used in Evaluating Time-Distributed Costs and Benefits* (27 March 1972).

Package of materials on economic analysis of 2809 projects.

Package of materials on economic analysis of 801 housing projects.

U.S. Army Regulation 11-28, *Economic Analysis and Program Evaluation for Resource Management*.

Audit Reports

Lease-purchase, Corps of Engineers Acquisition of Building in New Orleans, GAO/AFMD-88-56FS (June 1988).

Report of Audit, U.S. Army Corps of Engineers, New Orleans District, U.S. Army Audit Agency, Audit Report: SW 86-14 (4 June 1986).

Published Reports

Ault, Douglas K. and Robert L. Crosslin, *Private-Sector Financing of Child Development Centers, Final Report* (Logistics Management Institute, January 1987).

Economic Analysis of Family Housing at Fort Lewis, Washington (U.S. Army Corps of Engineers Seattle District Report, January 1985).

Eng, H.F.; B.J. Frankel, W.K. Goodermote, and T.W. Templar, *Facility Acquisition Financing*, NDU/ICAF-86-N48/ADB104280L (Industrial College of the Armed Forces, May 1986).

Financing Nonappropriated Fund (NAF) Major Construction, ADA161813 (Delta Research Corporation, 28 March 1985).

Huff, W.J., D. Wilner, and S. Noll, *Air Force Third Party Financing Management Guide, Ultra Systems Incorporated, Final Report*, ADA153508 (May 1984).

Land Prices and Housing Densities for 801 Projects in California (Naval Facilities Engineering Command [NAVFACENGCOM], January 1989).

White, B.F., *Third Party Financing and Generic Application for Navy Facilities*, ADA160918 (NAVFACENGCOM, 1985).

APPENDIX B:

Initial List of CFF Projects

Status	Facilities	2809	2821	2828	2828	2394	2667
			802 Housing	801 Housing	Energy	Land Lease	
Planned	Belvoir Bliss (2) Campbell Chaffee Dix (2) Harrison Huachucha Irwin (2) Jackson Kwajalein (2) Letterkenney Lewis McClellan Monmouth Ord Polk Redstone (3) Riley (3) Schofield Brks Sill (2) Walter Reed Leonard Wood	Benning Bragg Monmouth Oahu CFHO Stewart Hood Leavenworth McCoy Oahu CFHO Stewart Wainwright	Benning Bragg Campbell Devens Hood Leavenworth McCoy Oahu CFHO Stewart Wainwright			AAD Nevada Fitzsimmons New Cumberland Picatinny Leonard Wood (2)	Hunter-Liggett Ord (2)
Actual					Drum (4) Hood Polk (2) Wainwright (2)	Aberdeen PG Drum Redstone	Detroit ARS
Cancelled			Hood				
Total	31	6		20		10	3
Surveyed	10	1		17		5	3

APPENDIX C:

CFF Projects Surveyed*

Installation Name	Project Type	Authorization	Status	Date Questionnaire Sent	Information Received		
					Questionnaire	RFP	EA
(Package of briefing materials)							
Aberdeen Proving Ground**	Energy	2394	Actual	6/13/89			
Fort Bliss	Housing	801	Planned	6/13/89			
Fort Bragg	Housing	801	Planned	6/13/89	X		X
Fort Campbell	Housing Potable water	2809	Planned Planned	6/13/89 6/13/89	X		
38							
Fort Drum**	Housing (4) Energy Waste water	301 2,394 2809	Actual Actual Planned	6/13/89 6/13/89 6/16/89	X	X	X
Fort Devens	Housing	301	Planned	6/13/89	X		
Fort Hood**	Housing Housing	801 302	Actual Cancelled	6/13/89	X	X	X
Fort Hunter-Liggett	Land lease	2,367	Actual	6/13/89	X		
Fort Jackson	Laundry	2,309	Planned	6/13/89			
Letterkenney	Child development center	2809	Planned	6/13/89			
					(Have DD 1391 only)		

*Note: This study also reviewed GAO and AA audit reports on New Orleans District Office Building CFF.

** Visited installations.

CFF Projects Surveyed (Cont'd)

Installation Name	Project Type	Authorization	Status	Information Received			
				Date Questionnaire Sent	Questionnaire	RFP	EA
Fort Leavenworth	Housing	801	Planned	6/13/89			
Fort McCoy	Housing	801	Planned	6/13/89	X		X
New Cumberland	Energy	2394	Planned	6/13/89	X		
Oahu	Housing	801	Planned	6/13/89	X		
Fort Ord**	Land lease (2)	2667	Actual	6/13/89		X	
Picatinny	Energy	2394	Planned	6/13/89			
39	Fort Polk**†	Housing (2)	801	Actual	6/13/89	X	X
Redstone Arsenal**	Energy	2394	Actual	6/13/89	X	X	X
	Waste water	2809	Planned	6/13/89	X	X	X
	Sparkman complex	2809	Planned	6/13/89			
Fort Wainwright	Housing (2)	801	Actual	6/13/89			
	Housing (1)	801	Planned	6/13/89			
Walter Reed	Parking lot	2809	Planned	6/13/89			X

**Visited installations.

†Fort Polk consolidated maintenance facility not covered since project was in procurement selection.

APPENDIX D:

CFF Check List

Project Stage	3667 Land Lease	2394 Energy Supply	2809 Facilities	2821 802 Housing	2828 801 Housing
Project Need Assessment and Evaluation	<ul style="list-style-type: none"> Identify long term mission requirements Prepare segmented housing market analysis Identify available sites suitable for project Set land lease length equal to economic life of housing needed for mission Prepare initial economic analysis of life cycle costs of all feasible alternatives 	<ul style="list-style-type: none"> Identify long term mission requirements Develop accurate energy forecasts Estimate thermal demand under all reasonable contingencies Identify available sites sufficient for cogeneration or waste-burning plant Determine if trash tipping fees or PURPA payments make projects more attractive to developers 	<ul style="list-style-type: none"> Identify long term mission requirements Confirm need for facility services Estimate probable efficiencies that facilities owned and operated by private contractor could realize Prepare initial economic analysis of life cycle costs of all feasible alternatives 	<ul style="list-style-type: none"> Identify long term mission requirements Prepare segmented housing market analysis Determine availability of suitable sites (on-post and off-post) Set land lease length equal to economic life of housing needed for mission Prepare initial economic analysis of life cycle costs of all feasible alternatives 	<ul style="list-style-type: none"> Identify long term mission requirements Prepare segmented housing market analysis Determine availability of suitable sites (on-post and off-post) Set land lease length equal to economic life of housing needed for mission Prepare initial economic analysis of life cycle costs of all feasible alternatives

CFF Check List

Project Stage	2667 Land Lease	2394 Energy Supply	2809 Facilities	2821 802 Housing	2828 801 Housing
Bid Solicitation and Evaluation	<p>Hold bidder conference</p> <p>Issue RFPs</p> <p>Issue RFP amendments</p> <p>Require adequately detailed proposals and contract performance bonds</p> <p>Evaluate/screen experience and financial status of bidders</p> <p>Redo life cycle cost analysis of CFF relative to MCA based on "best and final offer"</p>	<p>Hold bidder conference</p> <p>Issue RFPs</p> <p>Issue RFP amendments</p> <p>Require adequately detailed proposals and contract performance bonds</p> <p>Evaluate/screen experience and financial status of bidders</p> <p>Redo life cycle cost analysis of CFF relative to MCA based on "best and final offer"</p>	<p>Hold bidder conference</p> <p>Issue RFPs</p> <p>Issue RFP amendments</p> <p>Require adequately detailed proposals and contract performance bonds</p> <p>Evaluate/screen experience and financial status of bidders</p> <p>Redo life cycle cost analysis of CFF relative to MCA based on "best and final offer"</p>	<p>Hold bidder conferences</p> <p>Issue RFPs</p> <p>Issue RFP amendments</p> <p>Require adequately detailed proposals and contract performance bonds</p> <p>Evaluate/screen experience and financial status of bidders</p> <p>Redo life cycle cost analysis of CFF relative to MCA based on "best and final offer"</p>	<p>Hold bidder conferences</p> <p>Issue RFPs</p> <p>Issue RFP amendments</p> <p>Require adequately detailed proposals and contract performance bonds</p> <p>Evaluate/screen experience and financial status of bidders</p> <p>Redo life cycle cost analysis of CFF relative to MCA based on "best and final offer"</p>

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